LIGHTING RESEARCH PROGRAM

Impact of Potential Lighting Code Changes In Stairwells

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The Potential for Lighting Code Changes In California Stairwells

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Abstract

This brief paper assesses, in layman's terms, the potential that owners and developers of commercial buildings in California might become subject to new building or fire codes that would require more light in exit stairwells. The paper concludes that, given current activity in five different code processes, it is likely that minimum lighting in stairwells will be increased to ten foot-candles (10FC or 108 lux) during occupied periods. However, this requirement is not likely to take effect in new buildings until 2007.

Background

Stairwell safety has been a public health issue, a building code issue, and a fire code issue for decades, certainly as long as modern building codes have been in effect. It is typically found in codes under the sections dealing with "paths of egress" from buildings, especially during emergencies. For at least the last 25 years, stairwell safety has been the subject of detailed, scientific research for which there is a respected body of published work. Recently, however, because of two horrific attacks on the World Trade Center in New York and a disastrous fire in a nightclub in Rhode Island, public attention has again been focused on the importance of stairwells that are typically out of sight and out of mind.

According to the literature, there are three key factors to the safe use of stairs: visibility, geometry of steps, and handrails. However, only visibility has an ongoing cost impact because building and fire codes demand that paths of egress for most commercial and large, multi-story residential buildings must be lighted 24 hours every day—whether used or not. To date, energy costs for lighting have been modest because codes have required that exit stairs be lighted to only one foot-candle (1FC or 10.8 lux). Code bodies have been reassessing this requirement and several have already accepted proposals that require lighting for exit stairs be increased to 10FC (108 lux) during occupancy. To mitigate the large jump in energy costs that would accompany such a requirement, these codes are also allowing the use of new lighting control technology that will reduce stairwell light levels back to 1FC (10.8 lux) during unoccupied periods.

This paper will look briefly at how the code making process works and will assess the extent to which the new code provision, increasing required lighting in stairwells, has been adopted—or not—in six relevant codes. The State of California is reviewed in particular so that an "educated guess" can be made about the possibility that this code change will ultimately affect building owners and developers in the state.

How Codes are Made and Adopted (Figure 1)

A full discussion of the process for making and adopting building and fire codes is vastly beyond the scope of this paper. It is a mammoth undertaking concerning several national and international organizations, dozens of committees, and hundreds of volunteers. However, to begin to understand where a code change is in the process, at least a simplified model of the process is helpful. As illustrated on the left margin of Figure 1, the code process is roughly divided into four steps:

1) Committee Work
   This is a catchall phrase to cover the beginning of the code-making process that includes hundreds of committees that meet regularly to monitor existing codes, to carefully consider proposals to modify existing codes, to vote on proposed code changes, and to revise model codes. These committees are made up of building or fire professionals, industry representatives, academics, and other experts. In Figure 1, this category includes the American National Standards Institute (ANSI), the International Code Council (ICC), the National Fire Protection Association (NFPA) in the non-governmental (NGO) sector and the Access Board in the Federal sector. The Access Board was created by Congress to oversee design guidelines for the Architectural Barriers Act (ABA) and the Americans with Disabilities Act (ADA). All of these organizations have websites that can be easily accessed using the acronym-of-the-organization.org.

2) Model Codes
   On a national basis, work of the expert committees is brought together in "model" codes, so called because they are models that can be referenced as needed. These model codes are typically highly detailed, technical, and can easily be of book length. They are published by sponsoring organizations and their content is protected by copyright. Figure 1 illustrates three building codes: International Building Code (IBC), the International Residential Code (IRC), and the new building code from the National Fire Protection Association, NFPA 5000. There are also the Life Safety Code (NFPA 101) and the Uniform Fire Code (NFPA 1). Although not a model code (it is actually Federal law), the ADA Accessibility Guidelines (ADAAG) is similar in that it specifies design standards that must be met for the construction or alteration in the private sector (places of public accommodation and commercial facilities) and the public sector (state and local government facilities).

3) State and Local Adoption
   Model codes become law when they are adopted by a local jurisdiction, typically a city or county. There are over 30,000 such jurisdictions in the US. Each jurisdiction may accept the model code "as is" or it may make amendments based on local conditions. It is possible for a new code provision to be added to the model code and then be removed by a local jurisdiction

before becoming local ordinance. An organization that doesn't like a code provision but can't get it "killed" at the national level can still get it removed at the local level.

As illustrated in Figure 1, in California the Building Standards Commission (BSC) is responsible for codifying and publishing approved building standards, approving model codes and standards for state buildings (including both California university systems), and working to make highly consistent building standards throughout California. In the case of the fire code, the BSC takes recommendations from the Western Fire Chiefs Association. The BSC publishes the California Building Code and the California Fire Code.

4) Enforcement
In the case of the building codes, enforcement is by local city or county building inspectors. For the fire code, enforcement is by the "Authority Having Jurisdiction" (AHJ) that in most cases is the Fire Marshal. Because codes are revised and adopted in various cycles (every few years), it is possible for the building code and the fire code to be out of sync and disagree. This puts the building owner or contractor in a truly awkward position that can sometimes be difficult to resolve. In California, the Building Standards Commission works to resolve these conflicts prior to adoption so that there will not be conflicting codes presented to the builder or developer. In the case of the ADA standards, they are enforced by the Department of Justice. If there is a problem, negotiations are required. If the problem cannot be resolved through negotiation, the Department of Justice files a lawsuit.

Status of the Proposed New Lighting Standard for Stairwells in the Model Codes

A new standard has been proposed that will increase the required amount of light in stairwells, during occupancy, from the current standard of one foot-candle (1FC or 10.8 lux) to 10FC (or 108 lux) on the stair tread or landing. In Figure 1, asterisks indicate all of the codes or code related organizations where this new lighting provision has been accepted. Following is a brief discussion of each.

- American National Standards Institute (ANSI) -- Accepted
On November 26, 2003, the Accredited Standards Committee A117 on Architectural Features and site Design of Public Buildings and Residential Structures for Persons with Disabilities approved American National Standard A117.1-2003 Accessible and Usable Buildings and Facilities. The "Final Proofing Draft Z-3" was published January 31, 2004 and the First Printing is scheduled for May 2004. This standard contains the following sections:

504 Stairways
504.8.1 Luminance Level. Lighting facilities shall be capable of providing 10 foot-candles (108 lux) of luminance measured at the center of tread surfaces and on landing surfaces within 24 inches (610mm) of step nosing.

504.8.2 Lighting Controls. If provided, occupancy-sensing automatic controls shall activate the stairway lighting so the luminance level required by Section 504.8.1 is provided on the entrance landing, each stair flight adjacent to the entrance landing, and on the landings above and below the entrance landing prior to any step being used.

http://www.iccsafe.org/cs/standards/a117/index.html

- NFPA 1: Uniform Fire Code™, 2003 Edition -- Accepted
  This code covers "the prevention of fire and explosion through the regulation of conditions that could cause fire or explosion and panic resulting therefrom." In the spring of 2003, Technical Committee UFC-AAA of NFPA approved the 2003 Edition of the Uniform Fire Code™. That code, which is updated every-other year, now contains the following sections:

  14.12 Illumination of Means of Egress
  14.12.1.2.2 Automatic, motion sensor-type lighting switches shall be permitted within the means of egress, provided that the switch controllers are equipped for fail-safe operation, the illumination timers are set for a minimum 15-minute duration, and the motion sensor is activated by any occupant movement in the area served by the lighting unit.

  14.12.1.3 The floors and other walking surfaces within an exit and within the portions of the exit access and exit discharge designated in 14.12.1.1 shall be illuminated as follows:
  (1) During conditions of stair use, the minimum illumination for new stairs shall be at least 10 Ft-candles (108 lux), measured at the walking surfaces.
  (2) The minimum illumination for floors and walking surfaces, other than new stairs, shall be to values of at least 1 Ft-candle (10.8 lux) measured at the floor.

  14.12.1.4 Required illumination shall be arranged so that the failure of any single lighting unit does not result in an illumination level of less than 0.2 Ft-candles (2.2 lux) in any designated area.

  http://www.nfpa.org/Codes/index.asp
  A no-cost registration is required to view this code on line.

- NFPA 101- Life Safety Code™ -- Accepted
  This code deals with "safety from fire and like emergencies. It covers construction, protection and occupancy features to minimize danger to life from fires, smoke, fumes, or panic before buildings are vacated." In the same 2003 adoption cycle as NFPA 1, the Technical Committee for Assembly Occupancies and Membrane Structures (ASF-AXM) approved the following provisions which are now part of this model code:

7.8.1.2.2 Automatic, motion sensor-type ....[exact same language as above]

7.8.1.3 The floors and other walking surfaces ….[same as above]

(1) During conditions of stair use….10 Ft-candles….[same as above].

[Same website as NFPA 1 above.]

- NFPA 5000 – Building Construction and Safety Code[tm] -- Pending/Likely
  The purpose of this code is to "provide minimum design regulations to safeguard life and limb, health, property, and public welfare by regulating and controlling the permitting, design, construction, quality of materials, use and occupancy, location, and maintenance of all buildings and structures within the jurisdiction and certain equipment specifically regulated herein." This is a new building code, written in competition to building codes written by the International Code Council (ICC). The current edition of this code is 2002 and is only its second cycle since inception. This code has yet to be accepted by any local jurisdiction.

  Section 11.8.1.3 of NFPA 5000, which covers Illumination of Means of Egress, still references the illumination of surfaces in exits to be 1 Ft-candle. This cycle of NFPA 5000 is a year behind the cycles for NFPA 1 and NFPA 101 discussed above. To bring NFPA 5000 in line with these other two codes, a Committee Proposal was submitted in the current cycle of proposals to revise NFPA 5000. This proposal has been non-controversial and it is anticipated that the new 10 Ft-candle and control references will be easily voted into the 2005 Edition of NFPA 5000.

  [Same website as NFPA 1 above.]

- ADA Accessibility Guidelines (ADAAG) -- Pending
  The Access Board, responsible for developing guidelines for implementing the Americans with Disabilities Act, is nearing completion of a very large, multi-year effort to update the guidelines and create a common set of technical criteria that the federal government will use to monitor compliance with ADA requirements. As of January, 2004, these new proposed guidelines were at the Office of Management and Budget (OMB) for approval. The old guidelines (Section 409.2 Exit Stairways-1996) did not address exit illumination. However, the committee responsible for this update is well aware of the recent work by ANSI and its approval of the new 10 Ft-candle standard. It is "rumored" that the 10 Ft-candle standard *may* be in the new ADAAG. This will be clear when the ADAAG is released from OMB within the next 2-3 months.

  http://www.access-board.gov/ada-aba/status.htm

- International Building Code (IBC)
  Prior to 1994, there were three separate organizations in the US publishing model building codes: the Building Officials and Code Administrators International, Inc (BOCA); the International Conference of Building Officials, Inc. (ICBO); and the Southern Building Code Congress International, Inc. (SBCC). In 1994, the three organizations collaborated to form the International Code Council (ICC). The ICC prepares and publishes both the International Building Code (IBC) and the International Residential Code (IRC).
  There were a few delays in this transition to create the ICC. During this time, NFPA decided to create NFPA 5000 in competition with the ICC. The work of the ANSI A117 committee informs both the NFPA and the ICC code making processes. Given the very recent acceptance of ANSI A117.1-2003 (above) it is not surprising that the 10 Ft-candle standard has not yet moved into the ICC, IBC, and IRC processes. When it does, it still may be in for some "tough sledding" according to those familiar with the process. The ICC committee process is substantially different from the NFPA committee process and so far has been less inclined to accept the 10 Ft-candle standard.

  http://www.iccsafe.org/cs/codes

In summary, concerning the current status of the new 10 Ft-candle lighting standard in the model codes, it has been accepted by both ANSI and NFPA. We don't yet know the outcome in the ADA Accessibility Guidelines, and there appears to be "tough sledding" in the ICC process. To have been accepted by both ANSI and NFPA gives the new lighting standard a lot of credibility. Whether or not the new model stairwell lighting standard will become law in California, however, has everything to do with code the adoption process unique to California, the subject of the next section.

The Code Adoption Process in California

In California, the Building Standards Commission (BSC) is "the boss" when it comes to codes. This independent commission is appointed by the Governor and confirmed by the State Senate. The commission takes what it wishes from the national model codes, listens to advice from organizations and professionals, resolves conflicts or makes clarifications, and then publishes the California Building Code and the California Fire Code. These apply to state owned buildings and the university systems. They are the basis for adoption by other state agencies. However, they must still be adopted by local jurisdictions before becoming local law. The BSC seeks to write uniform codes for California that will be adopted with the fewest possible amendments.

http://www.bsc.ca.gov/index.html

- California Uniform Fire Code
  When it comes to the California Fire Code, the Building Standards Commission relies heavily on input and recommendations from the Western Fire Chiefs Association (WFCA), a division of the International Association

of Fire Chiefs, which includes the ten most western states. The WFCA has adopted the 2003 Edition of NFPA 1 and has recommended that it be the basis for the 2004 Annual Code Adoption Cycle for the California Fire Code. Unless special action is taken by the Building Standards Commission to remove the 10 Ft-candle standard for exit stairs, which is unlikely, the new standard will become part of the 2004 California Fire Code. The deadline for submitting proposed code changes to the BSC is August 2, 2004. Accounting for review, comment, and BSC administrative work, it is anticipated that the 2004 Fire Code will be published late in 2005 and will be adopted by local jurisdictions starting in early 2006. As shown on Figure 1, the 10 Ft-candle standard is pending, though fairly likely, to be part of the 2004 California fire code and to be within the jurisdiction of local Fire Marshals by 2006.

http://www.wfca.com

- California Building Standards Code

  There have been two major problems in getting to a new draft of the California Building Code. First, because of a change of Governors and a moratorium by the new Governor on all new codes, the 2003 Annual Code Adoption Cycle had to be abandoned. As of May, 2004, all state agencies have withdrawn their proposed changes to the Building Code.

  Secondly, California is facing head on the difficulty of choosing between the model building codes proposed by the ICC and NFPA. After considerable deliberation, the Building Standards Commission chose the 2003 Editions of the NFPA 5000 Building Code and NFPA 1 Uniform Fire Code. But that decision remains highly controversial. As of March 1, 2003, the BSC issued a lengthy Adoption Plan that will not lead to a new code until 2007 (Figure 2).

  http://www.bsc.ca.gov/documents/visio-NFPA5000&1_AdoptionPlan.pdf

  It is far too early to see how this debate will be resolved. If NFPA 5000 is the "winner" it is highly likely that the BSC will rule in favor of including the 10 Ft-candle standard for exit lighting. It is already included in NFPA 1 and it is in process for being included in NFPA 5000. If the ICC is the "winner" the BSC will have to resolve the fact that NFPA 1 includes this standard and the IBC does not. Given the input already in hand from the Western Fire Chiefs Association that they are fully supportive of NFPA 1, there is a strong probability that the new 10 Ft-candle rule will be included in the new California codes but will not go into effect locally until 2007 or 2008.

The Situation for Existing Buildings

All of the above discussion concerning codes affects only new buildings about to be built or existing buildings undergoing such significant renovations as to force them to fall under new code provisions. But new buildings represent only a small percentage of the building stock in any one year. What about existing buildings?

Under the letter of the law, existing buildings can keep the exit lighting system they have. If that system produces one foot-candle on exit stair landings and treads, it will be sufficient under the code when it was built. One caution is due here. Some light fixtures commonly used in stairwells, like the old Circline fluorescent fixture, can degrade over time and produce less light than when they were installed. Building owners may want to check their existing fixtures to be sure they are still covered even under their "grandfathered" code.

However, liability is an issue that should be taken into consideration when reviewing existing exit lighting. According to the Consumer Product Safety Commission (CPSC) in 1998, there were over 400,000 injuries treated in U.S. Hospital Emergency Departments associated with stairs or steps. Recall from the opening paragraphs of this paper that the three key environmental factors for safe stairs are: visibility of stairs, geometry of steps, and handrails. Now that the new 10 Ft-candle standard has become accepted by three of the four most important model codes, it is highly likely that it will become an issue in reviewing liability cases where visibility is a possible factor in the fall. Building owners wishing to avoid future liability cases may wish to consider exit stair lighting upgrades even if they are not required by code.

Technology Exists to Mitigate the Energy Costs of More Exit Lighting

At least three lighting fixtures are now in production and offered for sale in California that combine a fluorescent lighting fixture and an occupancy sensor so that it is possible to meet provisions of the new lighting code that call for exit stair fixtures to provide 10 Ft-candles of light during periods of occupancy and to drop back to 1 Ft-candle when there is no occupancy. The PIER Lighting Research Program has supported development of one of these fixtures and is currently monitoring multiple installations of this fixture in California to be sure that it can meet all proposed code provisions. Initial findings are that this new technology can be installed with reasonable paybacks. Work is continuing to make this technology even more cost effective.

Summary

Given that:

- The public is currently highly sensitive to building exit safety,
- Visibility is a key element in exit stair safety,
- Three out of four model codes (and possibly the new ADA Guidelines) have adopted the 10 Ft-candle standard for exit stairs,
- The Western Fire Chiefs Association has recommended NFPA 1 as the basis for the new fire code in California,
- The California Building Standards Commission has initially chosen NFPA codes, that either include or soon will include the 10 Ft-candle standard, as the basis for the next California Building Code, and
- That lighting technology exists that can cost effectively provide higher light levels only when needed so as to keep energy cost increases modest.

This paper concludes that it is highly likely, in the range of 80-90% likely, that owners and developers of new buildings in California will be subject to the new 10 Ft-candle standard for exit lighting. However, given the current complexity of code adoption

in California, this new code will probably not come into effect before 2006 at the earliest and it may be 2007. It is anticipated that some percentage of owners and managers of existing buildings will also want to upgrade exit lighting to these standards as a matter of employee or tenant safety and as a hedge against future liability. The combine effect of these adoptions will be a substantial improvement in public health and safety with only a very modest increase in energy cost.

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Authorities Consulted:

- Sharon Grafton – Uniform Fire Code
- Mel Green – Melvyn Green and Associates
- Jeff Griffin – Western Fire Chiefs Association
- David Hattis – Building Technology Inc.
- Mike Nearman – California Building Standards Commission
- Jake Pauls – Consulting Services in Building Use and Safety

Websites Consulted:

- Access Board – www.access-board.gov
- American National Standards Institute (ANSI) – www.ansi.org
- California Building Standards Commission (BSC) – www.bsc.ca.gov
- International Code Council (ICC) – www.iccsafe.org
- National Fire Protection Association (NFPA) – www.nfpa.org
- U.S. Department of Justice (ADA) – www.usdoj.gov/crt/ada
- Western Fire Chiefs Association (WFCA) – www.wfca.org

Figure 1

10 Ft-candle Std

Code Adoption Processes

** Accepted
*P Pending
? Undecided

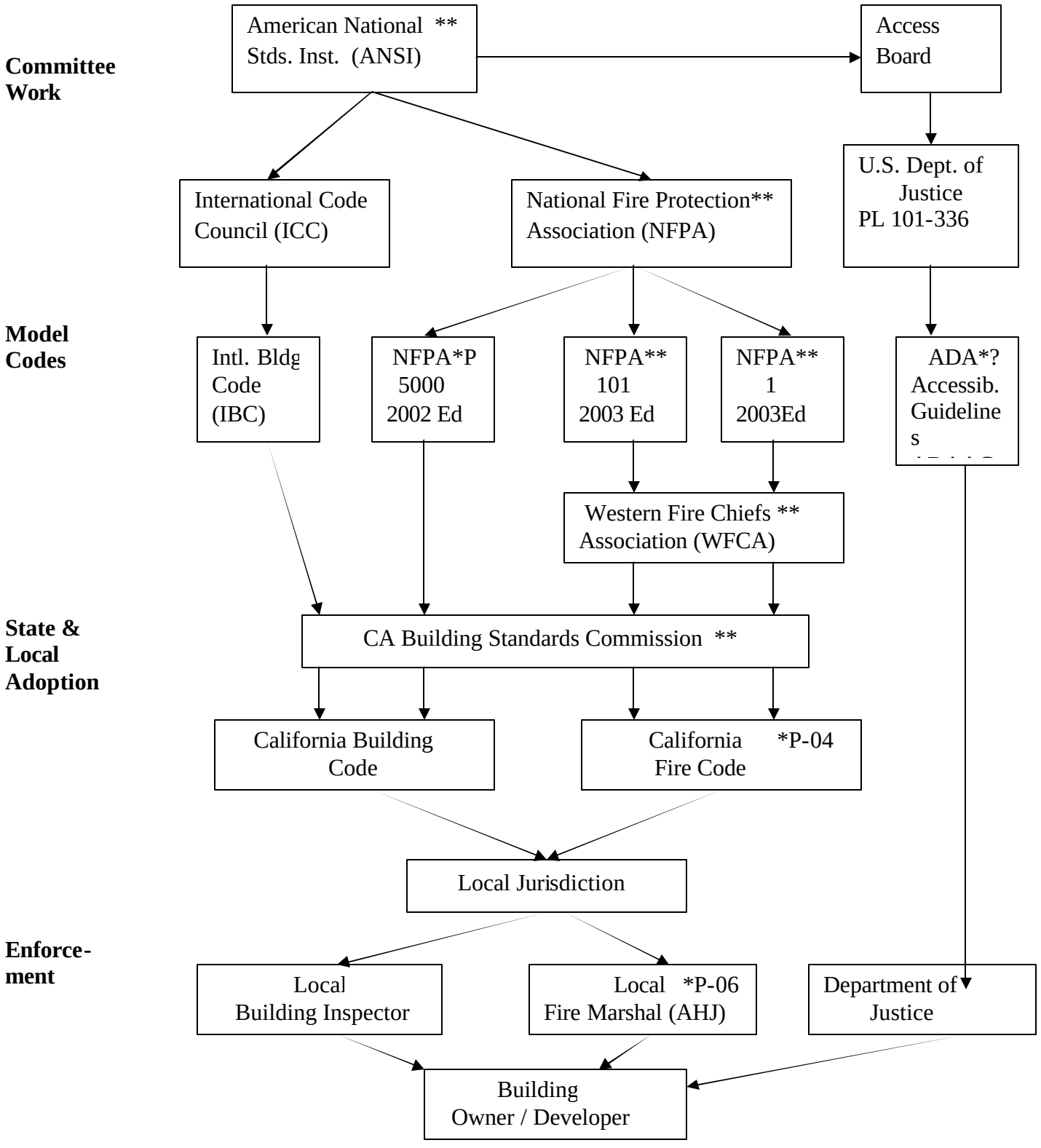

Figure 2

Building Code Adoption Process for California Through 2007

Please See

www.bsc.ca.gov/documents/visio-NFPA5000&1_AdoptionPlan.pdf